

WHAT IS CLAIMED IS:

1. A method for assembling a rotor assembly for gas turbine engine, said method comprising:

providing a first rotor blade that includes an airfoil, a platform, a shank, an internal cavity, and a dovetail, wherein the airfoil extends radially outward from the platform, the platform includes a radially outer surface and a radially inner surface, the shank extends radially inward from the platform, and the dovetail extends from the shank, such that the internal cavity is defined at least partially by the airfoil, the platform, the shank, and the dovetail;

coupling the first rotor blade to a rotor shaft using the dovetail such that during engine operation, cooling air is channeled from the blade cavity through an blade impingement cooling circuit for impingement cooling the first rotor blade platform radially inner surface; and

coupling a second rotor blade to the rotor shaft such that a platform gap is defined between the first and second rotor blade platforms.

2. A method in accordance with Claim 1 wherein each shank includes a pair of opposing sidewalls that extend generally axially between an upstream sidewall and a downstream sidewall, said coupling a second rotor blade to the rotor shaft further comprises coupling the second rotor blade to the shaft such that a shank cavity is defined between the first and second rotor blade shanks.

3. A method in accordance with Claim 2 wherein coupling the first rotor blade to a rotor shaft further comprises coupling the first rotor blade to the shaft such that during operation cooling air is channeled from the shank cavity through a purge slot defined within at least a portion of the platform radially inner surface.

4. A method in accordance with Claim 2 wherein coupling the first rotor blade to a rotor shaft further comprises coupling the first rotor blade to the shaft such that during operation the platform radially outer surface is film cooled by cooling

air channeled through a plurality of film cooling openings that extend between the platform radially inner and outer surfaces.

5. A method in accordance with Claim 2 wherein coupling the first rotor blade to a rotor shaft further comprises coupling the first rotor blade to the shaft such that during operation the platform radially outer surface is convectively cooled by cooling air channeled through a plurality of cooling openings that extend between the platform radially inner and outer surfaces.

6. A method in accordance with Claim 2 wherein coupling the first rotor blade to a rotor shaft further comprises coupling the first rotor blade to the shaft such that during operation the shank cavity is facilitated to be pressurized by airflow entering the cavity through a recessed portion of the rotor blade shank upstream sidewall.

7. A method in accordance with Claim 2 wherein coupling the first rotor blade to a rotor shaft further comprises coupling the first rotor blade to the shaft such that during operation the shank cavity is facilitated to be pressurized by airflow entering the cavity through a recessed portion defined radially inward from an angel wing extending outwardly from the rotor blade shank upstream sidewall.

8. A method in accordance with Claim 2 wherein coupling the first rotor blade to a rotor shaft further comprises coupling the first rotor blade to the shaft such that during operation at least a portion of the platform is facilitated to be convectively cooled by cooling air channeled through a plurality of openings extending at least partially through the platform.

9. A method in accordance with Claim 2 wherein coupling the first rotor blade to a rotor shaft further comprises coupling the first rotor blade to the shaft such that during operation at least a portion of a trailing edge of the platform is facilitated to be cooled by cooling air channeled through a recessed portion of the platform.

10. A method in accordance with Claim 2 wherein each rotor blade shank also includes a leading edge seal pin cavity and a trailing edge seal pin cavity,

said coupling a second rotor blade to the rotor shaft further comprises positioning a seal pin in only the trailing edge seal pin cavity prior to coupling the second rotor blade to the rotor shaft.

11. A rotor blade for a gas turbine engine, said rotor blade comprising:

a platform comprising a radially outer surface and a radially inner surface;

an airfoil extending radially outward from said platform;

a shank extending radially inward from said platform;

a dovetail extending from said shank such that an internal cavity is defined at least partially by said airfoil, said platform, said shank, and said dovetail; and

a cooling circuit extending through a portion of said shank for supplying cooling air from said cavity for impingement cooling of said platform radially inner surface.

12. A rotor blade in accordance with Claim 11 wherein said platform further comprises a purge slot formed within at least a portion of said platform radially inner surface, said purge slot configured to channel cooling air therethrough for purging a gap defined between adjacent said rotor blade platforms.

13. A rotor blade in accordance with Claim 11 wherein said platform further comprises a plurality of film cooling openings extending between said platform radially outer and radially inner surfaces for supplying cooling air for film cooling said platform radially outer surface.

14. A rotor blade in accordance with Claim 13 wherein said shank extends axially between a forward sidewall and an aft sidewall, at least a portion of said forward sidewall is recessed to facilitate increasing pressure of cooling air supplied through said plurality of film cooling openings.

15. A rotor blade in accordance with Claim 14 wherein said shank further comprises at least one angel wing extending outward from said shank forward sidewall, at least a portion of said shank forward sidewall radially inward from said at least one angel wing is recessed.

16. A rotor blade in accordance with Claim 11 wherein said platform further comprises a convex-side wall, a concave-side wall and a plurality of convection cooling openings, said convex-side and concave-side walls each extend between said platform radially outer and radially inner surfaces, said plurality of convection cooling openings extend between said cavity and said platform concave-side wall for supplying cooling air for convective cooling of said platform concave-side wall.

17. A rotor blade in accordance with Claim 11 wherein at least a portion of said platform is chamfered to facilitate reducing heat transfer coefficient of at least a portion of said platform.

18. A rotor blade in accordance with Claim 11 wherein said platform further comprises a leading edge sidewall and a trailing edge sidewall connected together by a convex-side wall and an opposite concave-side wall, at least a portion of said trailing edge sidewall is recessed between said platform radially outer and radially inner surfaces to facilitate platform trailing edge cooling.

19. A rotor blade in accordance with Claim 11 wherein said shank further comprises a leading edge seal pin cavity and a trailing edge seal pin cavity, each said pin cavity configured to facilitate sealing between adjacent said rotor blades.

20. A rotor blade in accordance with Claim 19 further comprising only one radial seal pin, said only one radial seal pin positioned within said trailing edge seal pin cavity when said rotor blade is coupled within the gas turbine engine, said shank leading edge seal pin cavity facilitates increasing platform film cooling.

21. A rotor blade in accordance with Claim 19 wherein at least one of said leading edge seal pin cavity and said trailing edge seal pin cavity is defined by a

pair of substantially parallel axially-disposed sidewalls that are connected by a radially outer sidewall that extends obliquely between said axially-disposed sidewalls.

22. A rotor blade in accordance with Claim 21 wherein said pin cavity radially outer sidewall facilitates enhancing radial pin sealing between adjacent said rotor blades.

23. A gas turbine engine rotor assembly comprising:

a rotor shaft; and

a plurality of circumferentially-spaced rotor blades coupled to said rotor shaft, each said rotor blade comprising an airfoil, a platform, a shank, and a dovetail, said airfoil extending radially outward from said platform, said platform comprising a radially outer surface and a radially inner surface, said shank extending radially inward from said platform, said dovetail extending from said shank for coupling said rotor blade to said rotor shaft such that an internal blade cavity is defined at least partially by said airfoil, said platform, said shank, and said dovetail, at least a first of said rotor blades comprising an impingement cooling circuit extending through a portion of said shank for channeling cooling air from said blade cavity for impingement cooling said platform radially inner surface.

24. A gas turbine engine in accordance with Claim 23 wherein each said shank comprises a pair of opposing sidewalls that extend axially between an upstream sidewall and a downstream sidewall, said plurality of rotor blades circumferentially-spaced such that a shank cavity is defined between each pair of adjacent said rotor blades, each said shank cavity radially inward from each said platform.

25. A gas turbine engine in accordance with Claim 24 wherein said first rotor blade further comprises a purge slot defined within at least a portion of said platform radially inner surface, said purge slot for channeling cooling air through a gap defined between adjacent said rotor blade platforms.

26. A gas turbine engine in accordance with Claim 24 wherein said first rotor blade platform further comprises a plurality of film cooling openings extending between said platform radially outer and inner surfaces for channeling cooling air from said shank cavity for film cooling said platform radially outer surface.

27. A gas turbine engine in accordance with Claim 24 wherein at least a portion of first rotor blade shank upstream sidewall is recessed to facilitate pressurizing said shank cavity.

28. A gas turbine engine in accordance with Claim 24 wherein each said rotor blade shank further comprises at least one angel wing extending radially outward from said shank upstream sidewall, at least a portion of said shank upstream sidewall radially inward from said first rotor blade at least one angel wing is recessed to facilitate pressurizing said shank cavity.

29. A gas turbine engine in accordance with Claim 24 wherein each said rotor blade platform further comprises a convex-side sidewall, a concave-side sidewall, and a plurality of cooling openings, said convex-side and said concave-side sidewalls each extend between said platform radially inner and outer surfaces, said plurality of cooling openings for channeling cooling air therethrough for convective cooling of said platform.

30. A gas turbine engine in accordance with Claim 24 wherein at least a portion of said first rotor blade platform is chamfered to facilitate reducing a heat transfer coefficient of said platform.

31. A gas turbine engine in accordance with Claim 24 wherein each said rotor blade platform further comprises a leading edge sidewall and an opposite trailing edge sidewall connected together by a pair of oppositely disposed platform sidewalls, at least a portion of said trailing edge sidewall is recessed between said platform radially outer and inner surfaces to facilitate cooling of said platform trailing edge.

32. A gas turbine engine in accordance with Claim 24 wherein each rotor blade shank further comprises a leading edge seal pin cavity and a trailing edge seal pin cavity, each said seal pin cavity sized to receive a seal pin therein to facilitate sealing between adjacent said rotor blades.

33. A gas turbine engine in accordance with Claim 32 wherein said first rotor blade further comprises only one radial seal pin, said radial seal pin is positioned within said trailing edge seal pin cavity when said first rotor blade is coupled within said gas turbine engine to facilitate increasing platform film cooling through said empty remaining seal pin cavity.

34. A gas turbine engine in accordance with Claim 32 wherein at least one of said first rotor blade leading edge seal pin cavity and said trailing edge seal pin cavity is defined by a pair of substantially parallel axially-disposed sidewalls that are connected together by a radially outer sidewall that extends obliquely between said axially-disposed sidewalls.

35. A gas turbine engine in accordance with Claim 34 wherein said first rotor blade pin cavity radially outer oblique sidewall facilitates enhancing radial pin sealing between adjacent said rotor blades.